

IN THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1 - 25 (Canceled)

26. (Currently Amended) Imaging apparatus adapted for in vivo imaging a particular volume of plant or animal tissue containing at least one photo-active molecular agent, the apparatus comprising:

a source of collimated light, said light having a frequency effective to penetrate substantially into the tissue, said light being adapted to promote simultaneous two-photon excitation (TPE) of the molecular agent contained within the tissue;

beam expanding apparatus for expanding said collimated light into an expanded beam of collimated light;

focusing apparatus for focusing the expanded beam of collimated light throughout a range of focal lengths extending from a surface of said tissue to a depth substantially beyond said surface, said light source and focusing apparatus cooperating to promote TPE of the molecular agent,

wherein a focal point or focal plane is adjustable over a distance of up to 100 mm with respect to said tissue;

a detector located proximate to the tissue and positioned to detect said light emitted by the molecular agent and which travels a path that does not retrace an optical path of the light incident on the tissue, said detector configured to produce a detected signal characteristic of the particular volume at which the light source has been focused;

a processor coupled to said detector; and

a modulation system associated with said light source, said processor being coupled to said modulation system and adapted to produce a demodulated energy signal which is characteristic of the particular photo-activated molecular agent.

27. (Previously Presented) The apparatus of Claim 26, wherein said light source produces a pulsed output having a pulse repetition frequency above about 75 megahertz and a sub-nanosecond pulse duration.

28. (Previously Presented) The apparatus of Claim 27 wherein said light source produces near-infrared light.

29. (Previously Presented) The apparatus of Claim 28 wherein said light source produces pulse energies of about 20 nanojoules.

30. (Previously Presented) The apparatus of Claim 28 wherein said light source comprises a laser.

31-32. (Canceled)

33. (Currently Amended) Apparatus adapted for in vivo medical diagnostic imaging comprising:

light source means for directing a confined light at and into tissue to be imaged, said light

being selected in frequency and energy to penetrate below a tissue surface and to promote TPE substantially only at a confocal region at a distance of up to 100 mm below said tissue surface, said light source means including beam expanding means and focusing means cooperating together to shape said confocal region;

means for varying a position of a confocal region of the light within a range of depths in the tissue to be imaged;

detector means positioned to receive and detect isotropic radiation emitted by a photo-activated molecular agent within the tissue after said agent has been excited using two-photon excitation;

a modulator means for modulating said light with a type of modulation and producing a modulated light; and

a processor coupled to said detector, said processor being coupled to said modulation system and adapted to produce a demodulated energy signal which is characteristic of said photo-activated molecular agent.

34. (Previously Presented) The apparatus of Claim 33:

wherein the light source means includes means for producing a collimated light beam; and

wherein the light source means includes focusing means for focusing the collimated light beam to a confocal region located with tissue at a point below the tissue surface.

35. (Previously Presented) The apparatus of Claim 34 wherein the means for producing a collimated light beam comprises a pulsed laser operating the near infra-red spectrum.

36. (Previously Presented) The apparatus of Claim 33 wherein said imaging apparatus is a microscope.

37. (Canceled)

38. (Currently Amended) An apparatus adapted for in vivo microscopic imaging to a distance of up to 100 mm within tissue comprising:

a light source, said light source producing a beam of light directed to or into a material to be imaged, wherein said light source includes beam expanding means and beam focusing means cooperating together to shape said beam of light into a confocal region, said light being selected in frequency and energy to penetrate into or below a surface of the material and to promote two-photon excitation substantially only in a confocal region to be imaged;

a modulator, said modulator cooperating with said light source to modulate said light with a type of modulation and produce a modulated light;

a detector positioned to receive and detect radiation emitted by a photo-activated molecular agent within the material after said agent has been excited using two-photon excitation; and

a demodulator, said demodulator coupled to said detector and producing a demodulated energy signal which is characteristic of the particular photo-activated molecular agent.

39. (Canceled)

40. (Previously Presented) An apparatus according to Claim 38 wherein said demodulator is a processor.

41. (Currently Amended) Apparatus adapted to in vivo medical diagnostic imaging comprising:

a light source, said light source producing light directed to or into deep tissue to be imaged, said light being selected in frequency and energy to penetrate into or below a surface of the tissue and to promote two-photon excitation substantially only in a region to be imaged;

a beam expanding apparatus adapted for expanding said light into an expanded beam of light;

a focusing apparatus adapted for focusing said expanded beam of light, said focusing apparatus being able to vary the position of the light within a range of depths in the region of tissue to be imaged, said range of depths extending up to 100 mm into said tissue to be imaged; and

a detector positioned to receive and detect radiation emitted by a photo-activated molecular agent within the material after said agent has been excited using two-photon excitation,

wherein said light source means includes means for producing a collimated light beam and focusing means for focusing the collimated light beam to a confocal region located with tissue at a point below the tissue surface.

42. (Previously Presented) An apparatus according to Claim 41 wherein said light source produces near-infrared light.

43. (Previously Presented) An apparatus according to Claim 42 wherein said light source is a laser.

44. (Previously Presented) An apparatus according to Claim 41 further comprising a modulator, said modulator cooperating with said light to modulate said light with a type of

modulation and produce a modulated light.

45. (Previously Presented) An apparatus according to Claim 44 further comprising a demodulator, said demodulator coupled to said detector and producing a demodulated energy signal which is characteristic of the particular photo-activated molecular agent.

46. (Previously Presented) An apparatus according to Claim 45, wherein said demodulator is a processor.

47. (Previously Presented) An apparatus according to Claim 41 wherein said light source produces a pulsed output having a pulse repetition frequency above about 75 megahertz and a subnanosecond pulse duration.

48. (Previously Presented) An apparatus according to Claim 41 wherein said light source produces pulse energies of about 20 nanojoules.

49-51 (Canceled)